

Biological_control_vegetables_generally



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Using Biological Control in the Home Vegetable Garden



Biocontrol: Augmentation



- Ø Sometimes natural enemies don't occur in large enough numbers at the right time to be effective
- Ø Add natural enemies in a timely fashion when needed
- Ø Many types of general and specialized natural enemies are commercially available
- Ø Need to know pest and plant to choose best species for control
- Ø No “recipes” for success



The Cast of Characters:

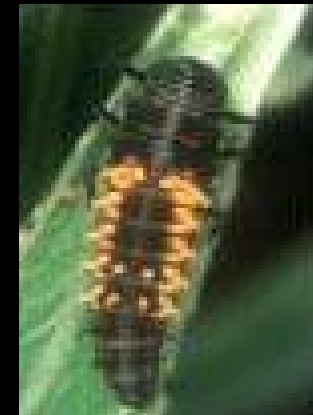
Some common biocontrol agents



Lady Beetles

Family Coccinellidae

- ø Many species
- ø Eat soft-bodied insects, especially aphids
- ø Larvae often unrecognized



Lady Beetles for Biocontrol

- n Convergent lady beetle most often sold
- n Adults can fly away
- n Some specialist species



Spider mite



Mealybug



Green Lacewings

Family Chrysopidae

- n Adults have membranous wings
- n Eggs laid on stalks
- n Larvae have sickle-shaped mouthparts
- n All larvae, some adults predators
- n Feed on aphids, other soft-bodied insects
- n Adults require honeydew or nectar



Green Lacewings for Biocontrol

- n Sold as eggs; hatch to voracious larvae
- n Better choice than lady beetles for release against aphids, soft-bodied insects



Minute Pirate Bugs

Family Anthocoridae

- n 1-2 mm
- n Black and white
- n Feed on mites, insects eggs and small insects
- n *Orius* species



Minute Pirate Bugs for Biocontrol

- n Several species commercially available
- n Used against:
 1. Aphids
 2. European corn borer and corn earworm on corn
 3. Potato aphids and potato leafhopper nymphs
 4. Codling moth eggs
 5. Whiteflies
 6. Spider mites



Stink Bugs

Family Pentatomidae

- n Medium sized
- n Green, brown, black
- n Produce foul odor when bothered
- n Not all predators; some important pests
- n Feed on caterpillars, beetle larvae and adults (e.g. Colorado potato beetle, Mexican bean beetle), others



Stink Bugs for Biocontrol

- n *Perillus bioculatus*
(twospotted stink bug)
- n *Podisus maculiventris* (spined soldier bug)



Flower or Hover Flies

Family Syrphidae

- n Adults look like bees
- n Larvae look like miniature slugs
- n Larvae eat soft-bodied insects, especially aphids



Syrphid Flies for Biocontrol

- Not sold commercially
- Many species
- Important in natural control
- Related fly, aphid midge, sold for use in greenhouses



Ground Beetles

Family Carabidae

- n 40,000 species worldwide
- n Usually dark colored, nocturnal
- n Adults feed on caterpillars, grubs, maggots, earthworms
- n Larvae also predaceous



Ground Beetles for Biocontrol

- n Not commercially available
- n Many species, small to large
- n Various habitats and prey
- n Important in natural control



Predatory Mites

- Many species in Phytoseiidae
- Feed on two-spotted spider mite and other phytophagous mites



Predatory Mites for Biocontrol

- n Many species commercially available for different conditions
 - *Phytoseiulus persimilis*
 - *P. macropilis*
 - *Galendromus occidentalis*
 - *Mesoseiulus longipes*
 - *Neoseiulus* (= *Amblysius*)
- n Used in greenhouses, fruit, other crops
- n (minute pirate bugs can also be used against spider mites)



Predatory Hymenoptera

- n Large wasps in Sphecidae (muddaubers) and Vespidae (paper wasps, yellowjackets)
- n Ants
- n Feed on caterpillars, various insects



Other Predators

- n Other bugs
(assassin, big-eyed, damsel)
- n Rove beetles
- n Spiders
- n Fireflies

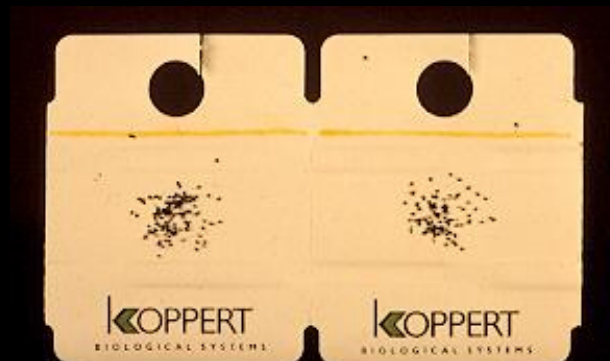




PARASITOIDS

Hymenoptera for Biocontrol

- n Several families
- n Many species
- n Most species specific
- n **Many commercially available**



Hymenoptera for Biocontrol

n Several species of Braconidae,
especially **Aphidiinae**

- *Aphidius* spp.
- *Aphelinus* spp.
- *Diaeretiella rapae*
- *Lysiphlebus testaceipes*

n **Produce a mummy**



Hymenoptera for Biocontrol

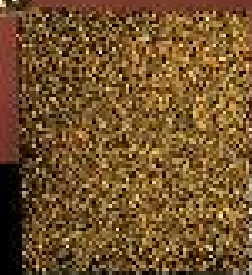
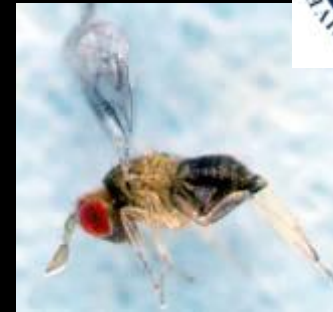
- n Numerous species, but only some commercially available
- n Some attack eggs, others caterpillars, other pupae



Trichogramma Wasps

Family Trichogrammatidae

- n Egg parasitoids
- n Very small
- n Widely used for biological control; several species commercially available
- n Attack eggs of moths and butterflies, beetles, flies, wasps, true bugs



Imported Cabbageworm

- n *Cotesia glomerata* and *C. rubecula* (Braconidae)
 - Parasitize larvae



- n *Pteromalus puparum*
 - Attacks pupae



ae)

Cabbage Looper

n *Copidosoma floridanum* (Encyrtidae)

- Attacks eggs, but emerges from last-instar larva



n *Cotesia marginiventris* (Braconidae)

- Prefer 1st instar larvae

n *Voria ruralis* (Tachinidae)

- “stings” larvae



Diamondback Moth

- n *Diadegma insulare* (Ichneumonidae)
 - Attacks later instars
 - Emerges from host pupa
- n *Diadromus subtilicornis* (Ichneumonidae)
 - Pupal parasitoid
- n *Microplitis plutellae* (Braconidae) and *Cotesia plutellae* (Braconidae)
 - Parasitize early instars



Tomato Hornworm

- *Cotesia* (= *Apanteles*) *congregata* (Braconidae)
 - Cocoons protrude from caterpillar's body
 - Adult wasps come out of end of cocoons



Wasps for Other Pests

- n Numerous species
- n Attack various stages of the pest
- n Only some commercially available



Root Maggots

- n *Trybliographa rapae* (Cynipidae)
cabbage maggot
- n *Aleochara bilineata*
(Staphylinidae)
 - Larvae parasitoids of pupae
 - Adults predators of eggs, maggots
- n Predators
 - Ground beetles *Agonoderus lecontei*, *A. comma*, *Bembidion quadrimaculatum*, *Microlestes* sp., etc.
 - Other rove beetles, e.g. *Atheta coriaria*



Mexican Bean Beetle

n *Pediobius foveolatus* (Eulophidae)

- Parasitizes 2-4 instars
- Creates a mummy
- Doesn't overwinter
- best for inoculation



Scales, Mealybugs, Whiteflies

- n Aphelinid wasps (Family Aphelinidae)
- n Tiny
- n Many also host-feed adults



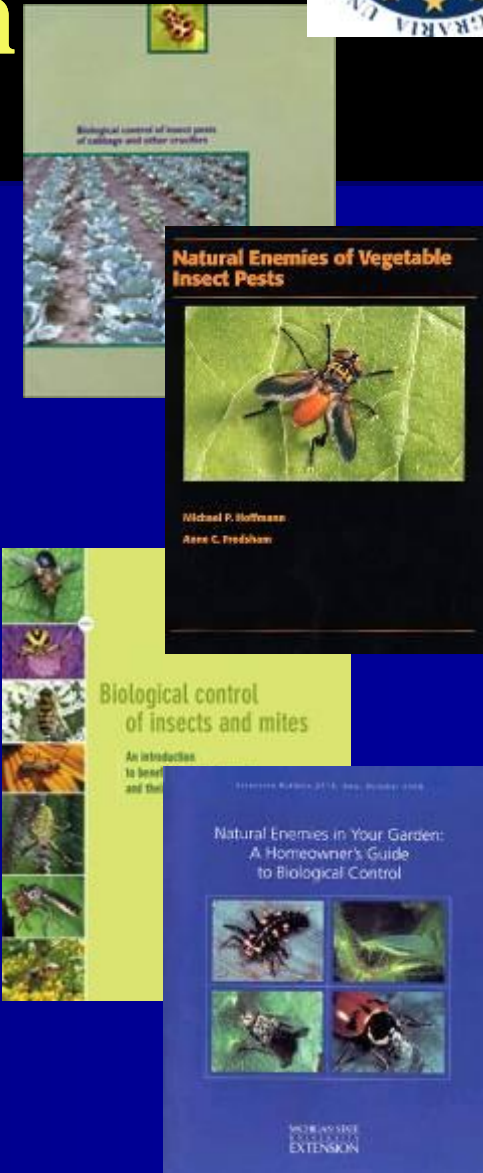
Many, many others





For More Information

- n *Natural Enemies of Vegetable Insect Pests* (Cornell Univ.)
- n *Natural Enemies in Your Garden: A Homeowner's Guide to Biological Control* (MSU)
- n *Biological control of insect pests of cabbage and other crucifers.* NCR Pub 471 (UW)
- n *Biological Control of Insects and Mites: An Introduction to Beneficial Natural Enemies and Their Use in Pest Management.* UWEX Pub A3842
- n *Alternatives in insect management.* NCR Pub 401 (Univ. Illinois)





For More Information

- n Midwest Biological Control News (UW)
www.entomology.wisc.edu/mbcn/mbcn.html
 - Using IPM and Biological Control in the Home Garden
www.entomology.wisc.edu/mbcn/fea204.html#aphid
- n Biological Control: A Guide to Natural Enemies in North America (Cornell Univ.)
www.nysaes.cornell.edu/ent/biocontrol/
- n Biological Control Information Center (NCSU)
cipm.ncsu.edu/ent/biocontrol/

Tachinid Flies

Family Tachinidae



- n 1,300 species in North America
- n All species parasitic
- n Resemble bristly houseflies
- n Most attack caterpillars and beetles
- n *Voria ruralis* parasitizes looper

